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The testing of chicken manure fertilizer doses to plant physiology components and bioactive compound of dewa leaf

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Abstract

Approximately 90% of the 7000 species of plants has a medicinal properties are found in Indonesia, one of them is dewa leaf (*Gynura pseudochina* (L.) DC). Bioactive compounds contained in extracts of dewa leaf has a function in healing various diseases of humans, such as to reduce levels of sugar blood, B hepatitis, skin medications, anti-tumor or anti-cancer. To grow and produce bioactive materials, dewa leaf cultivation aspects required a specific treatments or conditions. One important factor that must be considered in the cultivation was fertilization. The aims of this research was to study the growth and bioactive compounds of Dewa leaf as a potential medicinal plants that cultivated with various doses of chicken manure. The research was conducted at the Biofarmaka experimental station, Bogor Agricultural University. Chlorophyll analysis at Plant Molecular Biology Laboratory and post-harvest handling at the Post Harvest Laboratory, Department of Agronomy and Horticulture, Faculty of Agriculture, Bogor Agricultural University. The experiments were analyzed using a randomized block design, the first factor was the dose of chicken manure with three levels i.e. 0 g polybag-1 (control), 500 g polybag-1 and 1000 g of polybag-1. The experiment used four replications. The data were analyzed by analysis of variance with SAS 9.1.3, if significantly different continued with Duncan's Multiple Range Test at 5% level. The results showed that fertilizer treatment of 1000 g of chicken manure has the highest average at the diameter of the canopy (4 and 5 Weeks After Treatment) and plant height (4 WAT) compared to fertilizer treatment of 500 g of chicken manure or without the addition of chicken manure. However, it was not significantly different at variables of number of tillers, dry and wet weight and tuber crops, as well as the photosynthetic pigments variables (chlorophyll A, chlorophyll B, and carotenoids).

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Keywords: chicken manure fertilizer; bioactive compound; dose, *Gynura pseudochina* (L.) DC; physiology components

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1. Background

Indonesia is a country that has a tropical climate with a variety of plant species that live. Approximately 90% of the 7000 species of plants has medicinal properties are found in Indonesia, one of them is dewa leaf (*Gynura pseudochina* (L.) DC). Bioactive compounds contained in extracts of dewa leaf has a function in healing various diseases of humans, such as to reduce levels of sugar blood, B hepatitis, skin medications, anti-tumor or anti-cancer. Based on the research that has been done before, the plant of Dewa leaf are active content such as flavonoids and terpenoids as well as several other bioactive compounds like alkaloids, tannins, saponins, polyphenols, essential oils and eight phenolic acids [1].

Bioactive compounds in medicinal plants including of dewa leaf influenced by many factors. To grow and produce bioactive materials, dewa leaf cultivation aspects require specific treatments or conditions. One important factor that must be considered in the cultivation is fertilization in an effort to provide nutrients for plants. Nutrient source can be derived from organic fertilizer and inorganic fertilizer. However, today's organic farming is emphasized to help improve the quality of the environment and reduce the use of inorganic materials that can damage the environment. Additionally dewa leaf plants produced through organic farming systems have higher economic value as well as on other organic products. Demand for organic food increases with increasing number of people in the world who follow a healthy lifestyle.

Chicken manure is one of the organic fertilizer nutrients that have more than the other manure. Research conducted by Jasmine and Andriyani (2005) [2] showed that the 10 tons of chicken manure per hectare can increase vegetative growth and organic soybean production. Research Widowati *et al.* (2005) [3] also stated that the application of chicken manure crops always gives the best response in the first season. This happens because chicken manure decomposes relatively quickly and has a sufficient nutrient level when compared with the number of units equal to the other manure. Various results of this study indicate the importance to learn more about the use of manure in dewa leaf organic farming. This study aims to plant physiology component dewa leaf that has potential as a drug that is cultivated with various doses of manure.

2. Methodology

The experiment was conducted on February 20 until May 30, 2014 at the Biofarmaka experiment station 06°33.4’53”S and 106°43.1’43”E, Bogor Agricultural University (Fig. 1). Chlorophyll analysis was conducted in Plant Molecular Biology Laboratory 2 and post-harvest handling at the Post Harvest Laboratory, Department of Agronomy and Horticulture, Faculty of Agriculture, Bogor Agricultural University. Materials used in this study is seed of dewa leaf (*Gyunura pseudochina*), husk charcoal, chicken manure, topsoil, solution extractors acetris (a mixture of 85% acetone), and 15% Tris stock buffer (1% Tris, pH 8 with HCl). The tools used for experiment in the form of polybags size of 8 kg, tweezers/razor, scissors, analytical balance, plastic bags, paper envelopes, and agricultural tools such as hoes, chopper, sickle, shears, drill, buckets, and tools in laboratory used for analysis chlorophyll (the pit with a diameter of approximately 1 cm, porcelain mortar, micro tubes, test tubes, pipettes micro centrifuge apparatus, UV-Visible spectrophotometer, cuvet) GPS Garmin 60 CSx, software ArcGis 9.3. This study using a randomized block design with treatment doses of chicken manure, namely: Control = without the addition of chicken manure; A500 = addition of 500 g of chicken manure; A1000 = addition of 1000 g of chicken manure The medium used is a mixture of soil, rice husk and fertilizer dose of 250 g chicken manure. Husk is added in the mix of media so that the media weight to 8 kg. Treatment A500 and A1000 repeated 4 times and the control is repeated 6 times.

2.1. Laboratory observations

Observations were made on chlorophyll, anthocyanins and carotenoids. The method used is:

1. Samples of leaves that have been used are perfectly formed and located at the center position. Samples leaves cleaned of dirt by using a rag.
2. Leaves weighed as much as 0.02 g, then immediately crushed with a porcelain mortar with 2 ml acetris added and incorporated into the micro tube 2 ml.
3. Samples in micro tube centrifuged

4. The supernatant was taken 1 ml with a micro pipette, and then put into a test tube containing 3 ml acetris bringing the total to 4 ml solution (dilution factor is 4 ml / 1 ml of the supernatant = 4).
5. To reduce evaporation holes test tubes covered with marbles.
6. The absorbance measurement is done by inserting the sample into the cuvet and measured using a UV-Visible spectrophotometer at wavelengths of 663, 647, 537, and 470 nm.
7. The measurement results incorporated into the calculation formula Sims and Gamon (2002)

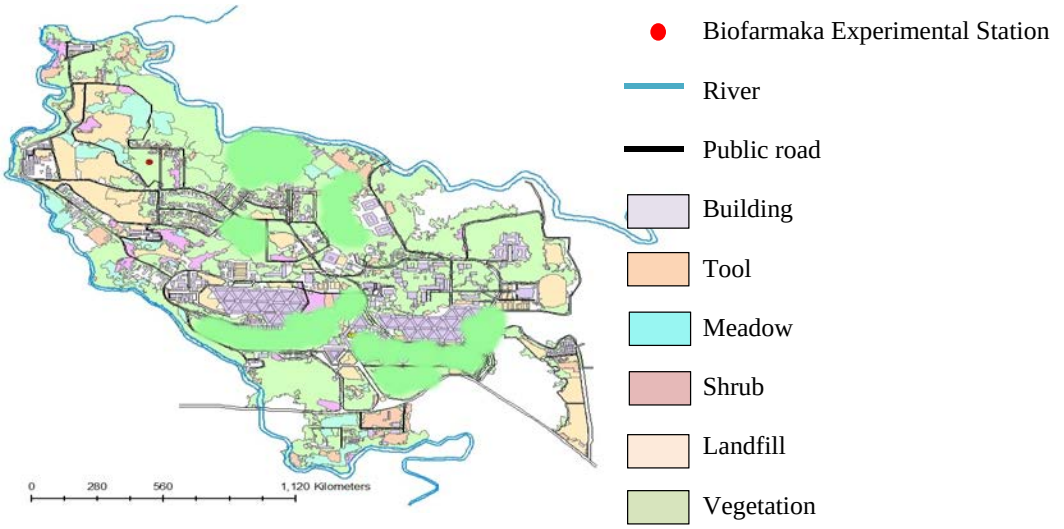

Fig 1. Study site

2.2. Observation

The observed variables are variables related to plant growth and development of Dewa leaves, among others:
1. The length of leaf (cm); measured starting from the leaf base to the tip of the leaf.
2. The width of the leaves of plants (cm); measured from both sides of the widest leaves (observed in the widest leaves).
3. Plant height (cm); measured from ground level to the highest growing point
4. The number of leaves (pieces); calculated from the number of leaves leaf-shaped perfect every week
5. The number of tillers; done by counting the number of seedlings that emerged
6. The weight of the wet and dry bulb (g) that is kiln dried for 3 days at a temperature of 60°C.
7. Measurement of chlorophyll A, chlorophyll B, anthocyanins and carotenoids

2.3. Data analysis

Data were analyzed by analysis of variance with SAS 9.1.3. If data was significant, further test Duncan's Multiple Range Test at 5% significance level could be used.

3. Results and Discussion

Transplanting seedlings Dewa leaf from the nursery into a polybag measuring 8 kg in accordance with the treatment combination of fertilization. Observations carried variables vegetative growth to 7 weeks after treatment. Based on statistical analysis, the treatment combination of fertilizer with the addition of 1000 g of chicken manure has the highest average at the variable diameter of the canopy (4 and 5 WAT; Table 4), plant height (4 WAT; Table 1), and the width of the leaf (5 and 6 WAT; Table 3) compared to the combination of fertilizer with the addition of

500 g of chicken manure or without the addition of chicken manure. Chicken manure is a source of nitrogen for plants. Chicken manure can increase the amount of nitrogen by 50% [4]. However, significant differences among the treatments do not look at the variable number of leaves (Table 2), leaf length (Table 3), and the number of seedlings (Table 5), and the weight of wet & dry harvested tubers (Table 6) for each week of observation, as well as on variable photosynthetic pigments (chlorophyll A, chlorophyll B, and carotenoids; Table 5). In fact, the anthocyanin content was also not detected in any treatment. Giving the addition of chicken manure significantly different only start when 4 WAT because chicken manure including slow release organic fertilizer or provide nutrients slowly. The real difference is seen also only up to 5 WAT because of the caterpillar that eats canopy (leaves, bone leaves, and stems).

Growth increased to 4 WAT and start ramp at 5 WAT at the variable crown diameter (Fig. 2a) and higher plants (Fig. 4). However, the growth pattern variable number of leaves (Fig. 2b), the length and width of leaves (Fig. 3) is fluctuating because there are leaves that grow and fall every time. In addition, irritated caterpillar pests (*Nyctemera coleta*) also interfere with growth so that plants cannot grow optimally. Flowering occurs in some plants also begin at 4 WAT as an indicator of the cessation of vegetative growth and crop harvesting time.

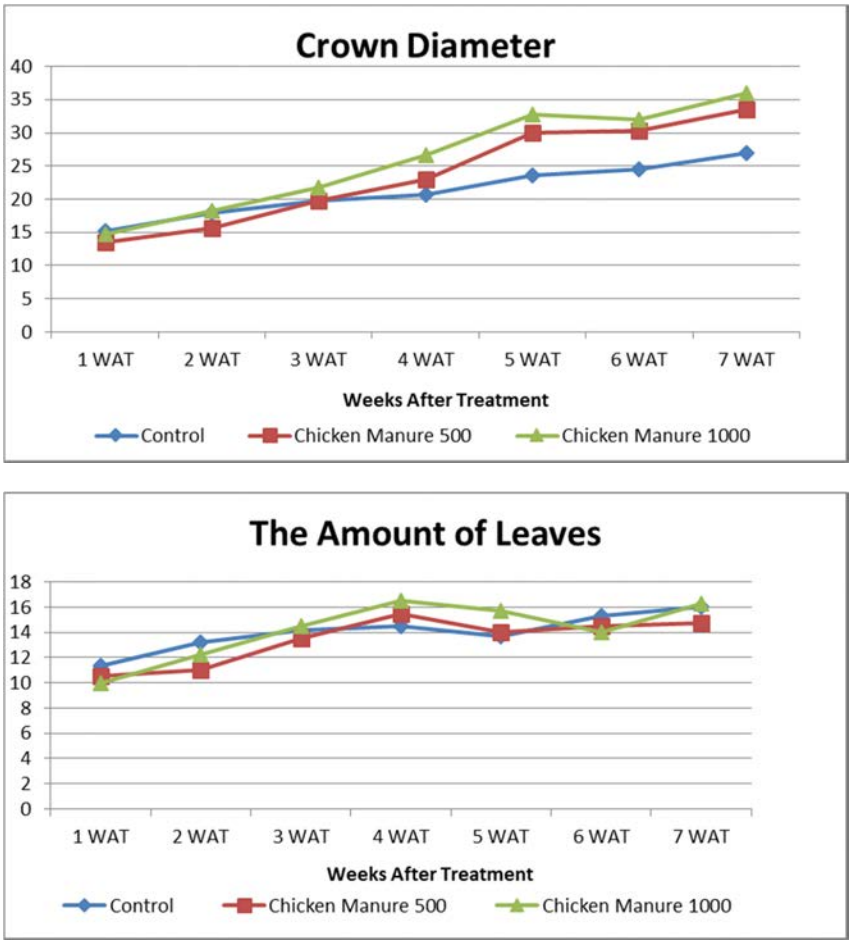

Fig. 2 Growth character (a) diameter canopy, (b) the amount of leaves up to 7 weeks after treatment**.**

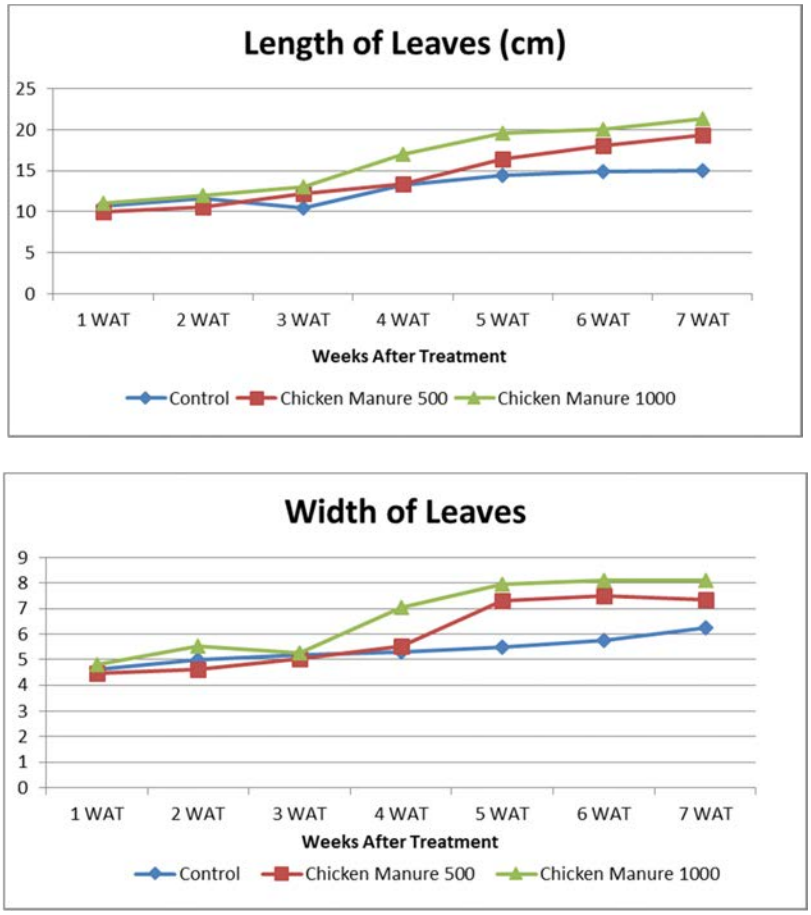

Fig. 3 Growth character (a) in length and (b) leaf width up to 7 weeks after treatment

4. Result

4.1. Plant height

Chicken manure significantly affected plant height at 4 weeks after treatment. Treatment of chicken manure 1000 g plant-1 resulted in the highest plant height, significantly different from the chicken manure treatment plants 500 g-1 or control. Chicken manure treatment plant height of 500 g plant-1 is not significantly different from the control plants. Treatments of chicken manure at 2 different doses are presented in Table 1.

Table 1 Growth in god leaf plant height (cm) by treatment with chicken manure at 1-7 weeks after treatment (MSP)

Treatment	1 WAT	2 WAT	3 WAT	4 WAT	5 WAT	6 WAT	7 WAT
Control	11.98	14.02	15.58	16.24b	18.28	19.43	20.80
Chicken 500	12.27	12.70	16.20	18.20ab	21.95	23.07	23.23
Chicken 1000	11.33	14.47	18.20	22.40a	25.93	28.80	28.88
F Test	0.64ns	0.15ns	0.26ns	0.03*	0.09ns	0.13ns	0.18ns
CoD (%)	10.68	8.83	11.47	10.55	14.86	18.59	18.10

Remarks: Figures on the same column followed by the same letter show no significantly different results based DMRT at the level of α = 5%. * = Significantly different at the level of α = 5%, ns = not significant, CoD = coefficient of diversity, WAT = weeks after treatment.

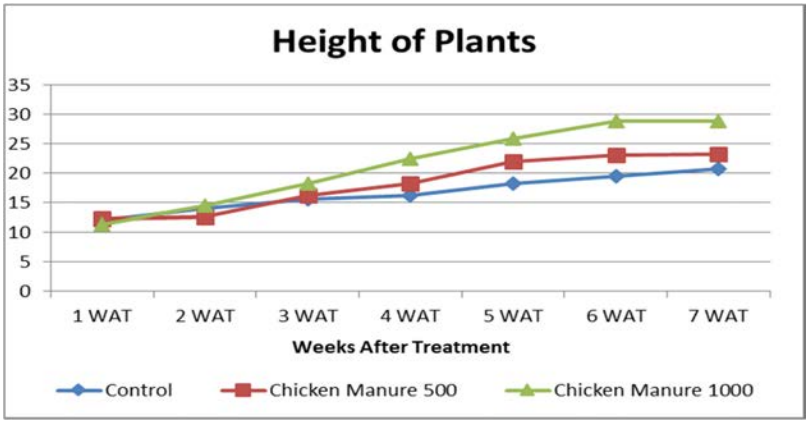

Fig. 4 The high growth of dewa leaves with chicken manure treatment of 1-7 weeks after treatment

Although statistically, fertilizer chicken only real effect on plant height at 4 WAT. However, based on Fig. 4, known chicken manure crop-1 produce 1000 g of high growth most plants better than chicken manure 500 g plant-1 or control since 2-7 WAT. Dewa leaf plant with chicken manure 1000 g plant-1 reaches a height of 28.88 cm, while control is only 20.80 cm at 7 WAT.

4.2. Number of leaves

Chicken fertilizer application did not significantly affect the number of leaves produced by dewa leaves. Chicken manure does not give effect to increase leaf dewa leaves from week 1 to week 7 after treatment. The numbers of leaves of deciduous plants reach 14-17 strands at 7 WAT. Number of leaves of deciduous dewa leaves on 2 chicken manure treatments are presented in Table 2.

Table 2 Number of dewa leaf with chicken manure treatment at 1- 7 WAT

Treatment	1 WAT	2 WAT	3 WAT	4 WAT	5 WAT	6 WAT	7 WAT
Control	11.33	13.17	14.17	14.50	13.67	15.33	16.00
Chicken 500	10.50	11.00	13.50	15.50	14.00	14.50	14.75
Chicken 1000	10.00	12.25	14.50	16.50	15.75	14.00	16.25
F Test	0.74ns	0.43ns	0.75ns	0.46ns	0.49ns	0.94ns	0.84ns
CoD (%)	10.75	16.67	26.16	27.17	23.41	22.10	23.16

Remarks: Figures on the same column followed by the same letter show no significantly different results based DMRT at the level of α = 5%. * = Significantly different at the level of α = 5%, ns = not significant, CoD = coefficient of diversity, WAT = weeks after treatment

4.3. The length and width of the largest leaf

Table 3 Growth in length and width of the largest leaves of deciduous dewa leaves with chicken manure treatment at 1-7 WAT

Treatment	1 WAT	2 WAT	3 WAT	4 WAT	5 WAT	6 WAT	7 WAT
Control	10.94	11.84	10.05	13.30	14.00	14.55	14.72
Chicken 500	9.98	10.58	12.17	12.47	16.40	17.03	18.00
Chicken 1000	11.00	12.03	12.50	16.98	19.58	20.77	21.38
F Test	0.58ns	0.15ns	0.77ns	0.11ns	0.06ns	0.06ns	0.13ns
KK (%)	12.95	8.08	18.36	15.65	14.55	16.28	18.36

Remarks: Figures on the same column followed by the same letter show no significantly different results based DMRT at the level of α = 5%. * = Significantly different at the level of α = 5%, ns = not significant, CoD = coefficient of diversity, WAT = weeks after treatment

Chicken fertilizer application does not significantly affect the length of the largest leaf plant dewa leaf from 1 to 7 WAT. But the chicken manure significantly affected plant leaf width at 5 and 6 WAT. Chicken manure at doses of 500 and 1000 g plant-1 clearly result in leaf width greater than the control. Chicken manure dose of 500 g plant-1

did not produce significantly different leaf width with 1000 g plant fertilizer-1. The long leaves at 7 MSP ranging between 14-22 cm. While the largest leaf width ranges between 6-9 cm.

4.4. Diameter Heading

Provision of chicken manure significantly affected leaf plant canopy diameter dewa leaves at 4-5 WAT. Provision of chicken manure 1000 g plant-1 resulted in the highest plant canopy diameter significantly different from the controls, but not significantly different from chicken manure 500 g plant-1. Diameter of the canopy plants reach 26-36 cm in 7 WAT. Crown diameter growth fertilizer plant with chicken presented in Table 4.

Table 4 Growth of the plant canopy diameter dewa leaves with chicken manure treatment at 1-7 WAT

Treatment	1 WAT	2 WAT	3 WAT	4 WAT	5 WAT	6 WAT	7 WAT
Control	15.15	17.98	19.78	20.75b	23.58b	24.56	26.96
Chicken 500	13.53	15.68	19.78	23.03ab	29.98ab	30.27	33.55
Chicken 1000	14.73	18.30	21.83	26.67a	32.75a	32.03	35.90
F Test	0.73ns	0.20ns	0.55ns	0.04*	0.05*	0.36ns	0.09ns
CoD (%)	15.05	10.90	12.75	11.90	13.91	23.22	14.42

Remarks: Figures on the same column followed by the same letter show no significantly different results based DMRT at the level of α = 5%. * = Significantly different at the level of α = 5%, ns = not significant, CoD = coefficient of diversity, WAT = weeks after treatment

4.5. Number of tillers, chlorophyll A, chlorophyll B and carotenoid

Chicken fertilizer application did not significantly affect the number of tillers at 6-7 AT. Besides chicken manure does not provide a real influence on the content of chlorophyll A, chlorophyll B and carotenoid produced dewa leaf plant leaves at 7 WAT. Number of tillers produced per plant reaches 5-8 puppies at 7 WAT. The content of chlorophyll A produced 0.3-0.5 mg g-1, chlorophyll B 0.1-0.2 mg g-1 while carotenoids reach 0.1-0.14 mg g-1. A higher chlorophyll content than chlorophyll B and carotenoid in 7 WAT. Number of tillers, chlorophyll A, chlorophyll B and carotenoid dewa leaves at various doses of chicken manure are presented in Table 5.

Table 5 The number of tillers, chlorophyll A, chlorophyll B and carotenoid dewa leaves at various doses of chicken manure.

Treatment	Number of Tillers		Chlorophyll A	Chlorophyll B	Carotenoid
	6 WAT	7 WAT	……mg g^{-1}…….....		
Control	3.00	5.17	0.348	0.141	0.121
Chicken 500	2.75	6.50	0.309	0.117	0.110
Chicken 1000	3.50	7.50	0.443	0.169	0.139
F Test	0.74ns	0.17ns	0.33ns	0.32ns	0.49ns
CoD (%)	33.44	34.65	22.28	22.38	20.49

Remarks: Figures on the same column followed by the same letter show no significantly different results based DMRT at the level of α = 5%. * = Significantly different at the level of α = 5%, ns = not significant, CoD = coefficient of diversity, WAT = weeks after treatment

4.6. Weight of wet and dry bulb

Chicken fertilizer application did not significantly affect the weight of the wet bulb and dry harvested at 7 WAT. Total weight of the wet bulb that can be harvested at 7 WAT 7-18 g plant-1, and the dry weight of tubers produced ranges between 1.6-4 g plant-1. The weight of the wet bulb and dry deciduous dewa leaves with various doses of chicken manure are presented in Table 6.

Table 6 Effect of treatment of wet and dry bulb weight in 7 weeks after treatment

Treatment	Wet Weight (g)	Dry Bulb Weight (g)
Control	13.90	2.48
Chicken 500	7.99	1.62
Chicken 1000	18.12	3.66
F Test	0.32 ns	0.43 ns
CoD (%)	37.05	35.36

Remarks: Figures on the same column followed by the same letter show no significantly different results based DMRT at the level of α = 5%. * = Significantly different at the level of α = 5%, ns = not significant, CoD = coefficient of diversity, WAT = weeks after treatment.

5. Discussion

In this experiment, chicken fertilizer application did not significantly affect several variables vegetative of dewa leaf. Chicken fertilizer application only real effect on plant height at 4 WAT, the largest in the 5-6 leaf width and diameter crown at 4-5 WAT. Chicken manure significantly affected plant height only at 4 WAT, then not real in the next week. In the study Rosmaliah (2003) [5] chicken manure real effect on plant height, dewa leaf started 2-8 WAT. Chicken fertilizer application increased plant height *Ocimum basilicum* (kemangi) 1-4 WAT [6], ginseng (*Panax quinquefolius)* 1-6 WAT (Susanti 2006) [7], 3-27 ciplukan (*Physalis angulata L*) WAT [8], tempuyung *(Sonchus Arvensis)* 8 and 16 WAT (Prasad 1994). Chicken manure significantly affect the width of the largest leaf at 5-6 WAT, while Rosmaliah (2003) [5] reported the chicken manure biggest influence on leaf width from 2-8 WAT. Chicken manure only affects the diameter of the crown at 4-5 MSP, as well as ciplukan which only affects the 9, 12, 27 HST [8].

Chicken fertilizer application did not significantly affect the weight of the wet and dry bulb on 7 WAT. Allegedly tubers harvested young and still growing so it has not reached the maximum size. Research of Rosmaliah (2003) [5] reported the chicken manure influence the weight of wet and dry bulb on 8 WAT. Sulianti (1999) [9] chicken manure can produce the highest god tuber weight leaf at 24 WAT. Increased doses of chicken manure 5-15 tons ha-1 increases the weight of the wet and dry bulb ginseng on 6 WAT [7]. Chicken manure significantly affect the weight of the wet and dry ciplukan plants were harvested at 4 WAT [8].

Chicken manure did not significantly affect the content of chlorophyll A, chlorophyll B, and carotenoids in the dewa leaves harvested 7 WAT. Allegedly age young leaves were analyzed. Shade levels significantly affected the content of chlorophyll and carotenoid dewa leaves the age of 12 WAT [10]. In addition, leaf samples were harvested alleged to have levels of aging and the health of different leaves.

6. Conclusions

Chicken manure is a source of nitrogen for the plants so that more fertilizer is then the plant will grow well. This study that shows the combination treatment of fertilizer with the addition of 1000 g of chicken manure has the highest average at the variable diameter of the canopy (4 and 5 WAT) and plant height (4 WAT) compared to the combination of fertilizer with the addition of 500 g of chicken manure or without the addition of manure chicken. However, significant differences among the treatments do not look at the variable number of number of tillers, dry and wet weight and tuber crops, as well as the variables photosynthetic pigments (chlorophyll A, chlorophyll B, and carotenoids).

Giving the addition of chicken manure significantly different only start when 4 WAT as chicken manure, including organic fertilizers provide nutrients slowly. The real difference is seen also only up to 5 WAT because of the caterpillar that eats canopy (leaves, bone leaves, and stems). Growth increased to 4 WAT and start ramp at 5 WAT at the variable crown diameter and plant height, while for variable number, leaf length and width of the pattern of growth has fluctuated because there are leaves that grow and fall every time. Flowering also occurs in some plants starting at 5 WAT thus indicating a dewa leaf crops.

References

1. Nirwan, Aziz SA. Multiplication and leaves anthocyanin pigmentation god (*Gynura pseudochina* (L) DC) In *Vitro*. *Bul. Agron*. 2006;**34**(2): 112-118
2. Jasmine M, Andriyani W. Effect of chicken manure and green manure *Calopogonium mucunoides* on the growth and production of soybean crops organically grown young. *Bul. Agron*. 2005;**33**(2):8-15.
3. Widowati LR, Widati S, Jaenudin U, Hartatik W. Effect of Organic Fertilizer Compost Enriched with Mineral Materials and Biological Fertilizer on the properties of soil, Nutrient Uptake and Organic Vegetable Production. Research Project Report Agribusiness Development Program, Soil Research Institute; 2005.
4. Dikinya O, Mufwanzala N. Chicken manure-enhanced soil fertility and productivity: Effects of application rates. *Journal of Soil Science and Environmental Management* 2010;**1**(3):46-54.
5. Rosmaliah E. Effect of nitrogen fertilizer and chicken manure on leaf production god (*Gynura pseudochina* L. (DC.)) [Thesis). Bogor (ID): Institut Pertanian Bogor; 2003.
6. Simatupang DV. Pengaruhdosis manure on growth, the production of fresh leaves, and essential oil content of the two accessions of basil (Ocimum basilicum L.) [thesis]. Bogor (ID): Institut Pertanian Bogor; 2010.
7. Susanti H. Production of biomass and materials bioaktifKolesom (Talinum triangulare) on various Origin of seeds, the doses of chicken manure, and planting medium composition [thesis]. Bogor (ID): Institut Pertanian Bogor; 2006.
8. Rosani T. Effect of doses of chicken manure on growth and biomass production plant ceplukan (Physalis angulata L.) [thesis]. Bogor (ID): Institut Pertanian Bogor; 2006
9. Sulianti SB. Effect of various planting media for vegetative growth and tuber production in Gynura pseudochina (L) DC. Botanical Research and Technical Reports. Bogor (ID): Center for Biology-LIPI; 1999.
10. Pradnyawan SWH, Mudyantini W, Marsusi. Growth, nitrogen content, leaf chlorophyll and carotenoid *Gynura procumbens* [Lour] Merr. at different shade levels. *Biopharmaceutical* 2005;**3**(1): 7-10